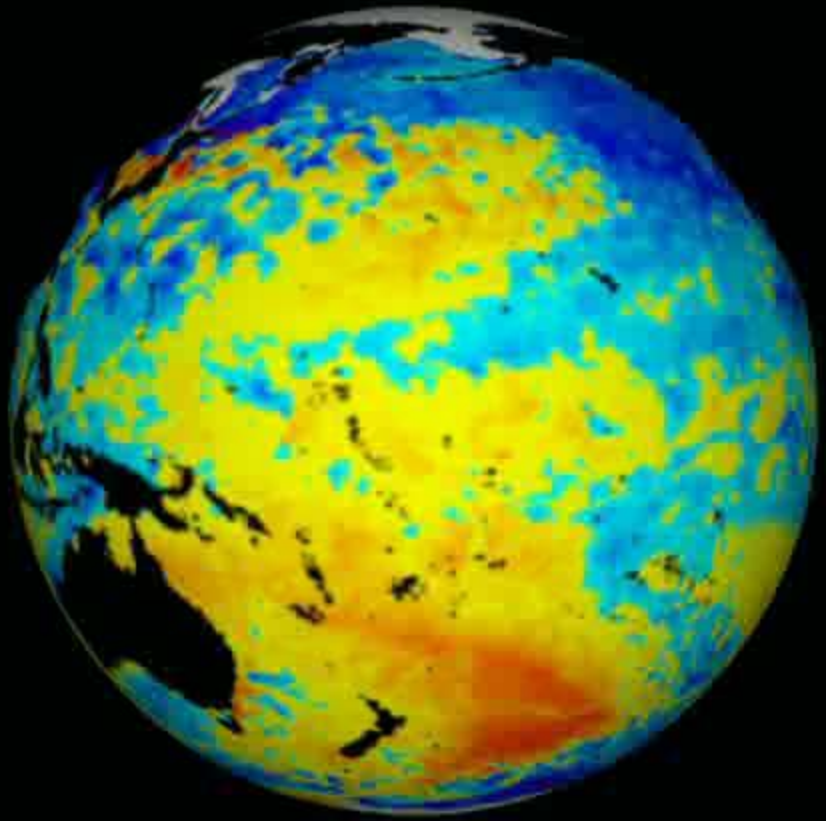
NOAA's Coral Reef Watch Program
&
USCRTF's Climate Change and Coral Bleaching

AE Strong



Satellite SST Anomalies

January – November 2002

Research Planning Session to
Support CREWS Modeling Efforts
January 13-17, 2003
Caribbean Marine Research Center
Lee Stocking Island (LSI), Bahamas

Coral Reef Watch

Program Leaders: NESDIS – Satellite -- Alan Strong
OAR – *in situ* -- Jim Hendee

NESDIS Team:

Office of Research and Applications (**ORA**)
Alan Strong

Office of Satellite Data Processing and Distribution (**OSDPD**)
John Sapper

National Climatic Data Center (**NCDC**, Boulder)
Mark Eakin

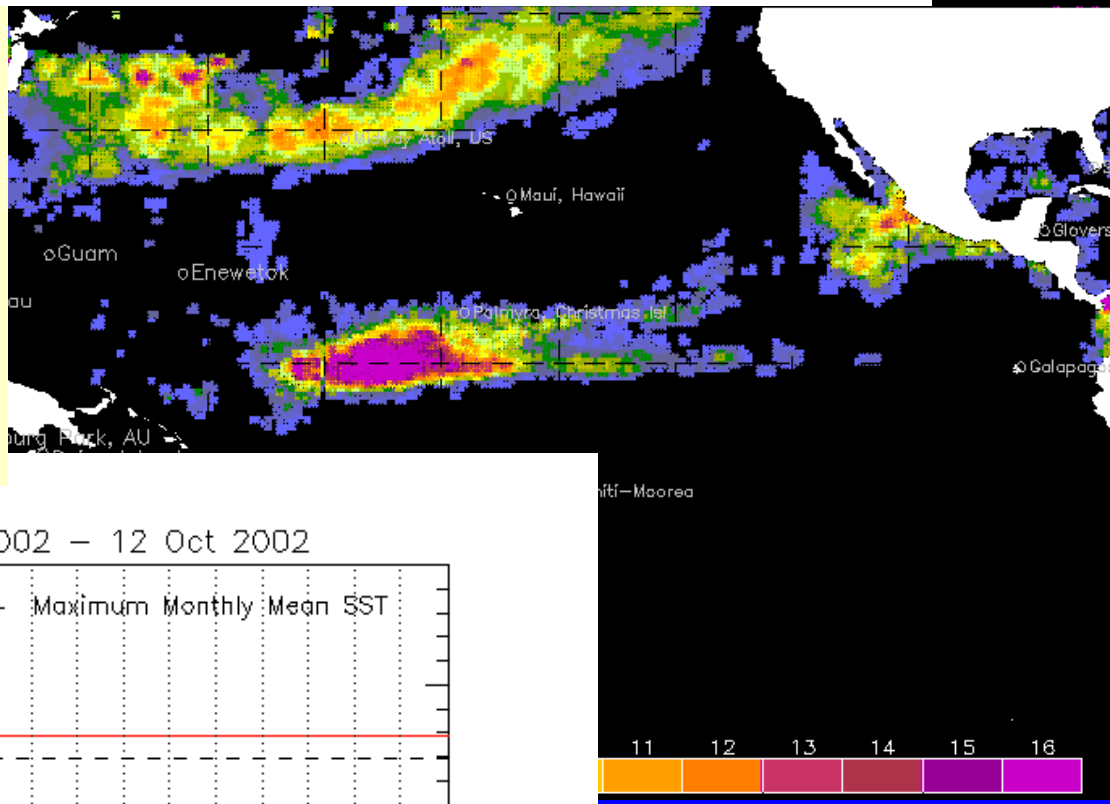
National Oceanographic Data Center (**NODC**) - CoRIS
Parmesh Dwivedi

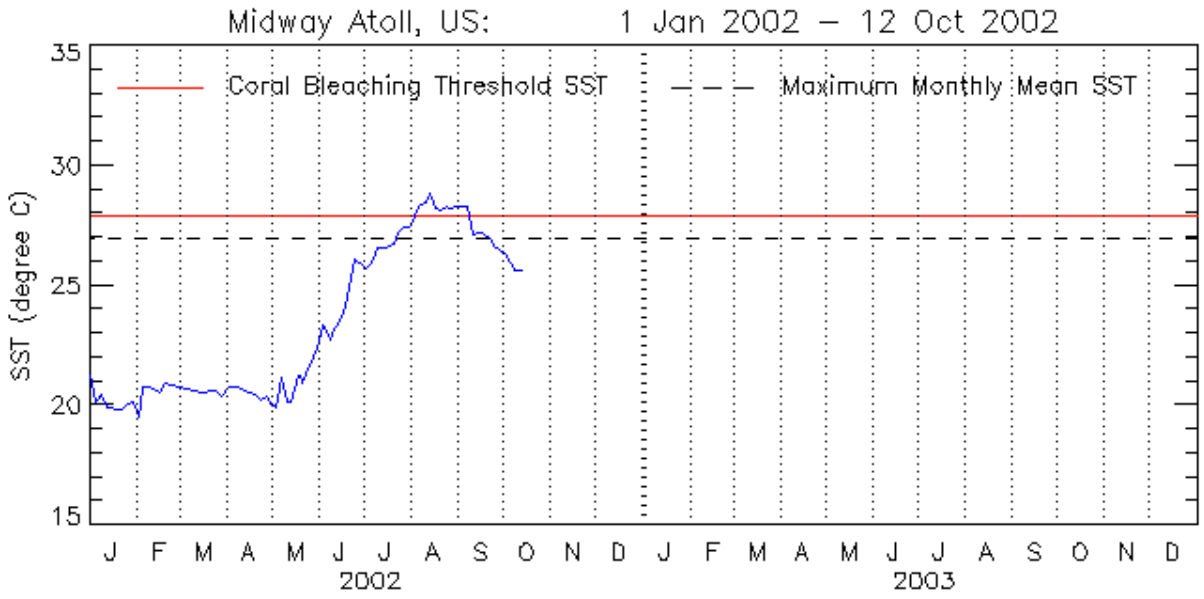
Coral Reef Watch - NESDIS

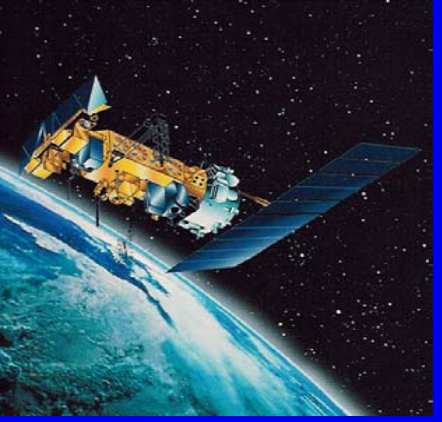
Degree Heating Weeks for 7 September, 2002

Thermal Stress at Midway
Started 1st August
Stopped 7th September

NESDIS Bleaching Warning issued 7th August



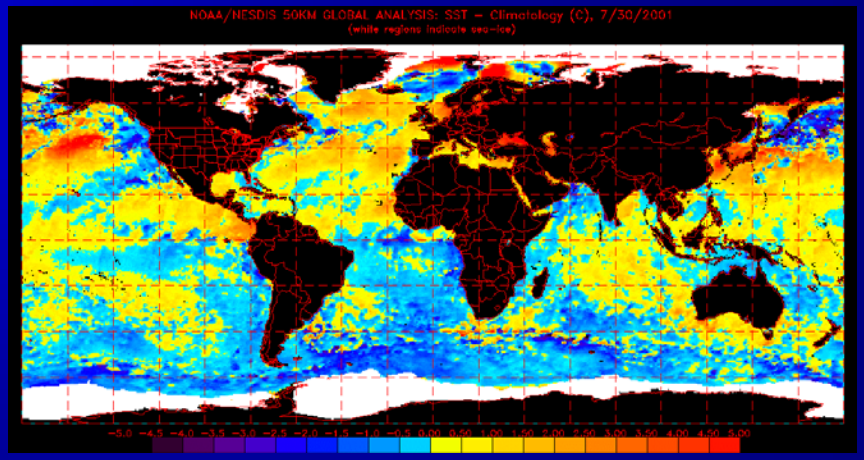




Coral Reef Watch - NESDIS

External Collaborators/projects:

- Australian Agreement
  - Australian Institute of Marine Science (AIMS)
  - Great Barrier Reef Marine Park Authority (GBRMPA)
  - University of Queensland (’03?)
- The Nature Conservancy
- The World Bank / GEF



Future directions:

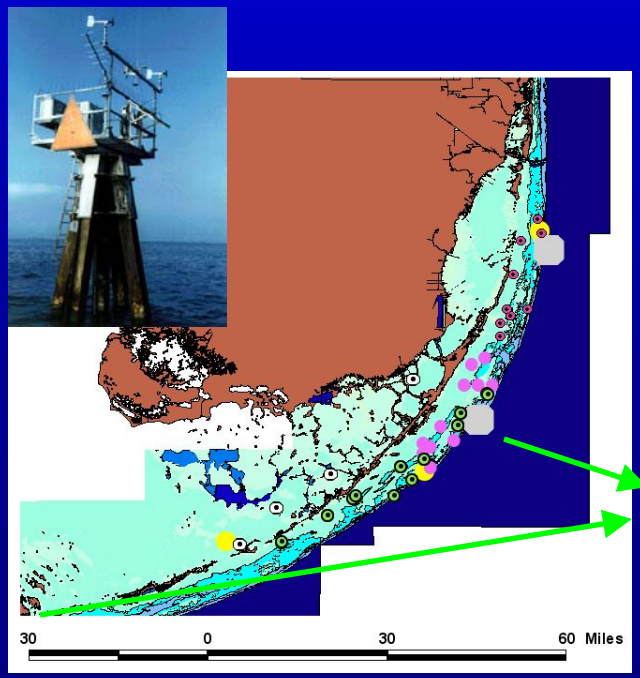
- Improved spatial resolution for Satellite products
- Satellite based trend analysis
- Inclusion of other satellite data such as wind
- Improved product delivery via web
  - including better regional focus & GIS
- Development of bleaching predictive tools

Coral Reef Watch - NCDC

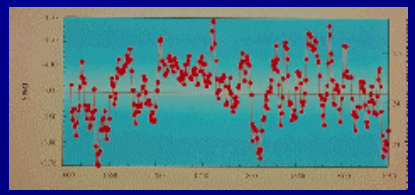
"Retrospective monitoring" using paleoclimate proxy records from reefs with OAR/CREWS and CMAN environmental monitoring stations

Target #1: Florida Keys National Marine Sanctuary

NESDIS/NCDC/Paleoclimatology Program
University of Miami
University of South Florida
(with U.S. Geological Survey)
Nova University

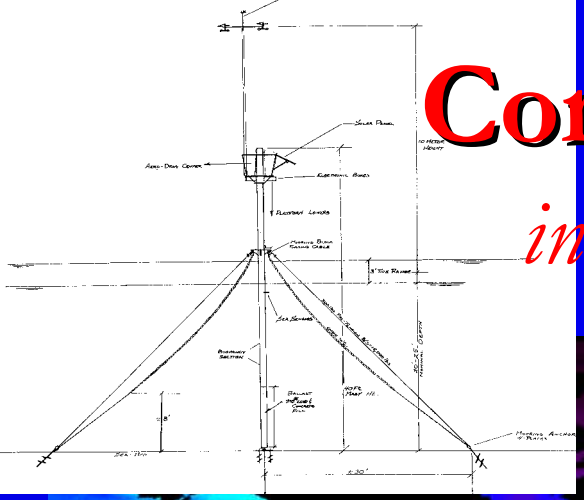


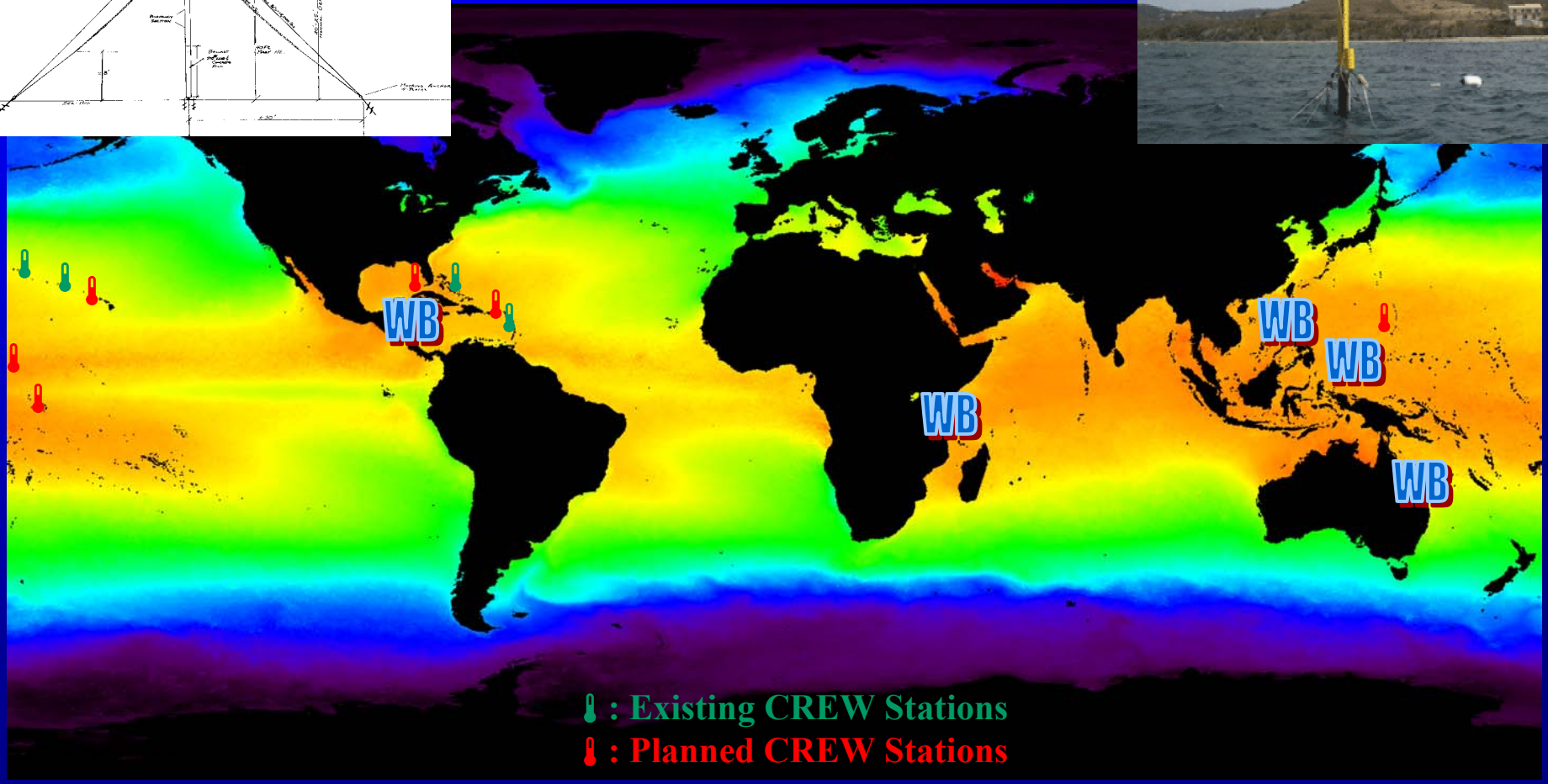
Cores from Molasses Reef, Looe Key now being analyzed



Coral Reef Watch – OAR

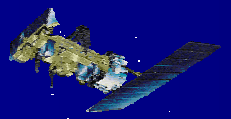
in situ monitoring - CREWS





Use of expert systems to provide a real-time bleaching warning

Coral Reef Watch (CRW)



NOAA/NESDIS

Satellite monitoring*

Modeling

+

In situ monitoring

NOAA/OAR

Reef Ecosystem Environment Conditions

providing early warnings & long-term monitoring of key coral reefs

* The focus of this presentation

World Bank Coral Targeted Research GEF

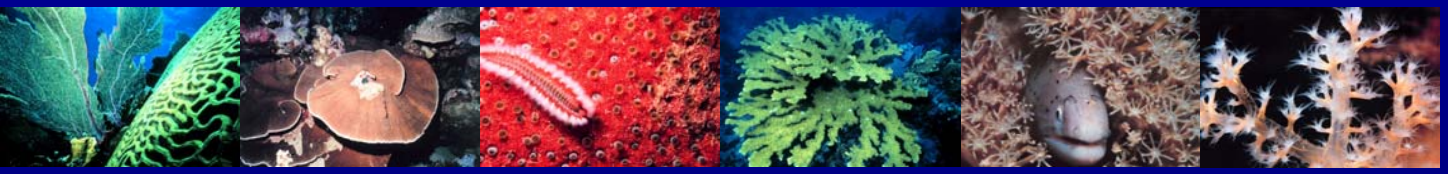
Joint Session:

Bleaching WG
Disease WG
Remote Sensing WG

Puerto Morelos, Mexico

September 9-22, 2002

Unidad Académica Puerto Morelos,
Instituto de Ciencias del Mar y Limnología



Proposed site - Palau

- High habitat diversity
- Diverse geomorphology
- High species diversity
- Good record of remote sensing
  (pre-bleaching imagery)
- Good infrastructure – PICRIC
- Sites with recently-dead and living reefs
- Below trade-wind belt
- Edge of ENSO activity
- IKONOS imagery available
- Unlikely to lose equipment
- Flight logistics low cost

& possibility of NOAA CREWS site

New CREWS Mast Design

Salt River - USVI

- **IGOS Coral Sub-Theme Report**
  Integrated Global Observing Strategy

- **USCRTF – Coral Reefs & Climate Change**
  US Coral Reef Task Force

IGOS
Coral Sub-Theme

- **Report due May 2003**
- **Integrates satellite and *in situ* systems to**
  - provide early warnings and watches
  - monitor
  - provide long term trends of indices

"Coral reefs appear to be the first major ecosystem type to show rapid degradation at a global scale due to human impacts."

Recently released IGOS Ocean Theme Report

USCRTF
"Coral Reefs & Climate Change"

New Threat Action Item:

- Climate Change and Coral Bleaching
- Workshop (DoI/EPA/NOAA)
  - June 2003 - Hawaii

Assessing Impacts of Climate Change

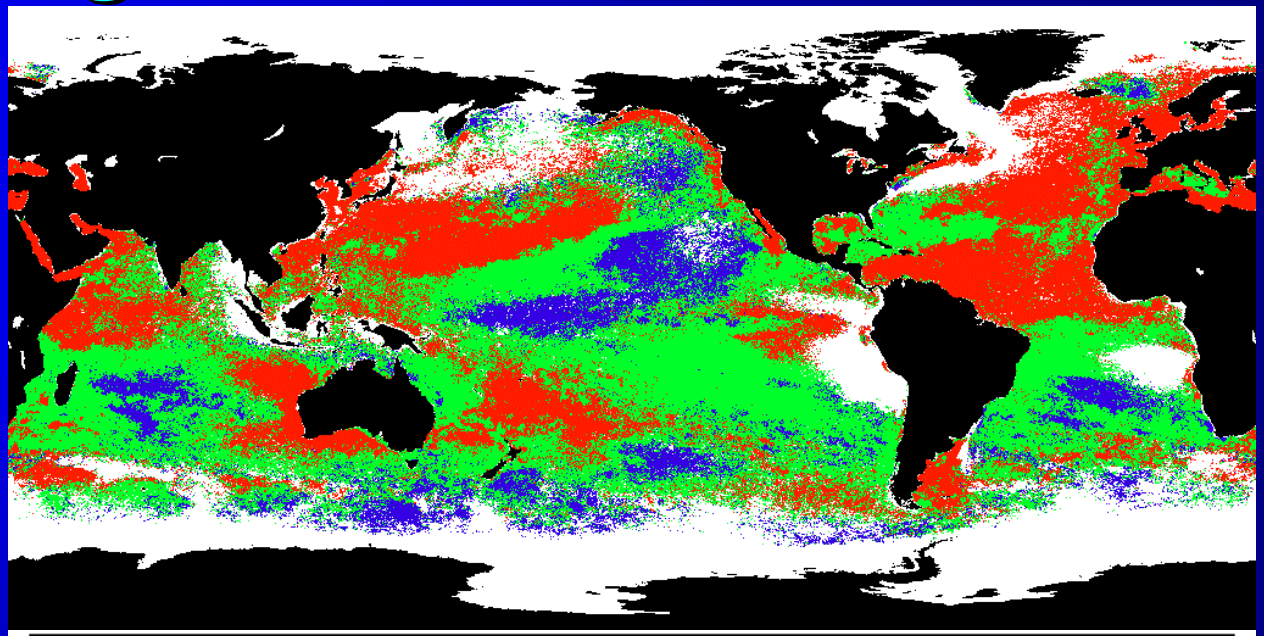
- USCRTF
  - New Threat: Climate Change & Coral Bleaching
    - Al Strong (NOAA)
- IGOS Coral Sub Theme Report - Al Strong
- New MPA tool
  - Bleaching "Risk Maps" - William Skirving (AIMS)
- US Climate Change Science Program
  - Ecology - Patty Glick (NWF)

Changing SST Tendencies?

1985 - 2000

after 1998

El Niño



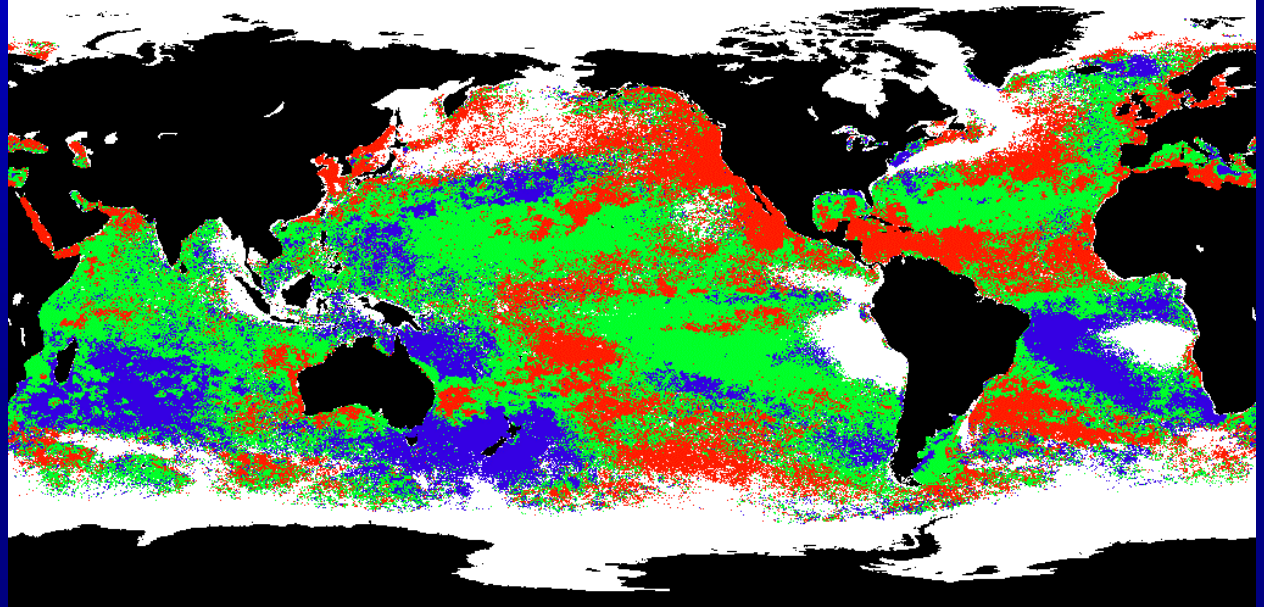
Tendency = °C/decade

Missing data	< -0.2	-0.2 to 0.2	> 0.2

1985 - 1996

before 1998

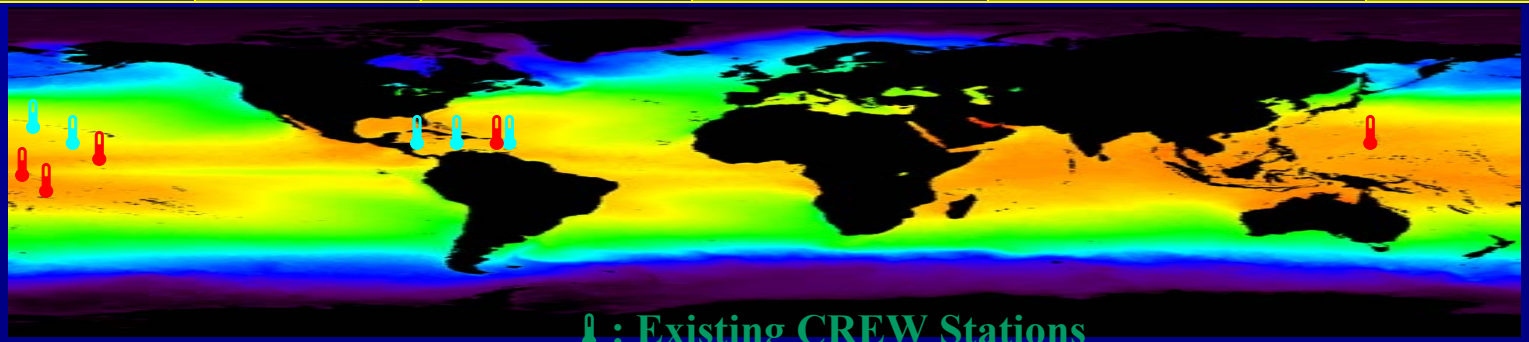
El Niño



Present SST Trends at planned CREWS Sites

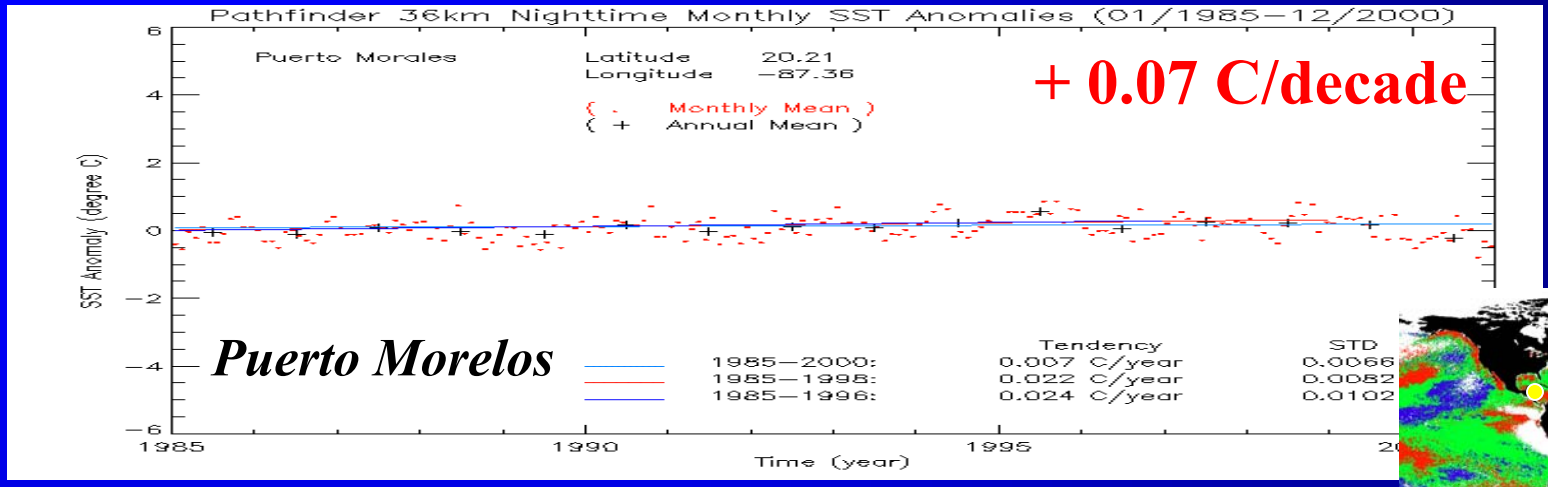
-- 1985 - 2000 --

Site	Stations	Lat	Long	Date - proposed	SST Trend (Deg C/decade)
CN Mariana I.	2	15.3	145.7	2005	+ 0.32
USVI	2	17.8	-64.8 (Salt R)	2002	+ 0.24
Puerto Rico - SW	1	17.9	-67.1	2003	+ 0.23
Guam	1	13.5	144.7	2005	+ 0.23
Puerto Rico - NE	1	18.4	-65.5	2005	+ 0.22
FLA - Keys	6	24.6	-82.9 (Dry Tort)	1990s	+ 0.19
HI - Midway	1	28.2	-177.3	2001	+ 0.18
American Samoa	2	-14.2	-169.7 (Ofu)	2003/2004	+ 0.17
Bahamas - LSI	1	23.8	-76.1	2001	+ 0.09
Johnston Atoll	1	16.7	-169.5	2006	- 0.07
HI - Oahu	1	21.1	-157.2	2003	- 0.14
Palmyra/Kingman	1	5.9	-162.1	2006	- 0.28
Howland/Baker	1	0.2	-176.5	2006	- 0.59

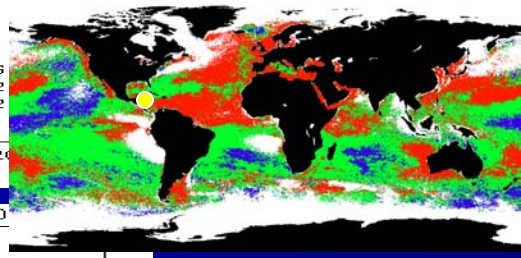


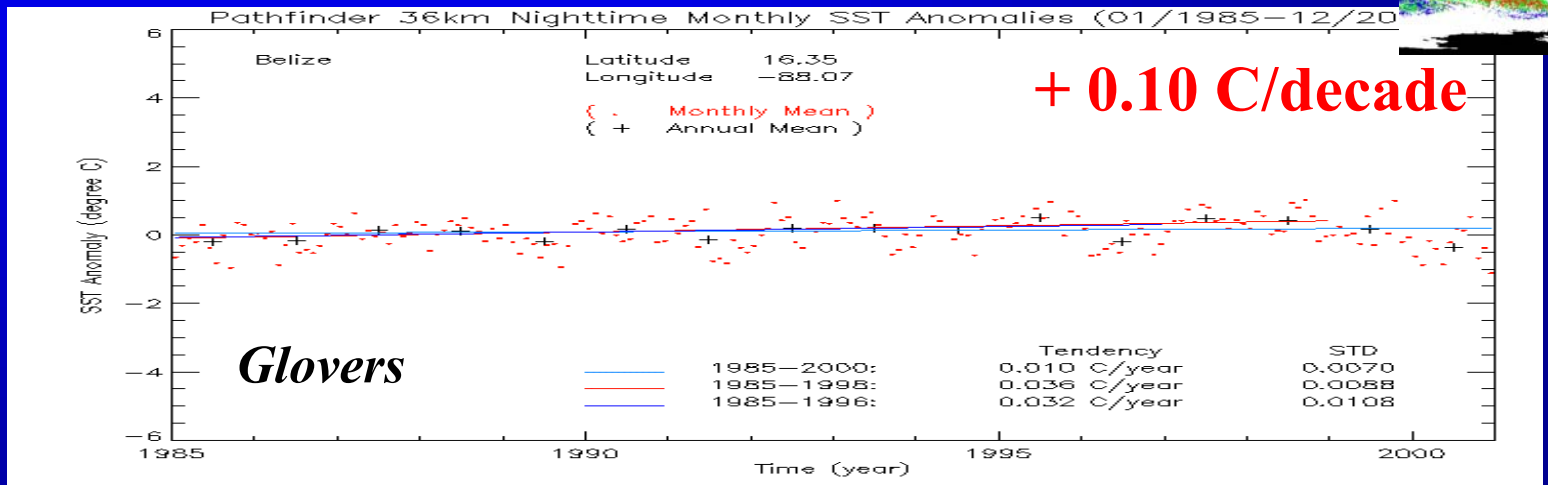
: Existing CREW Stations

: Planned CREW Stations

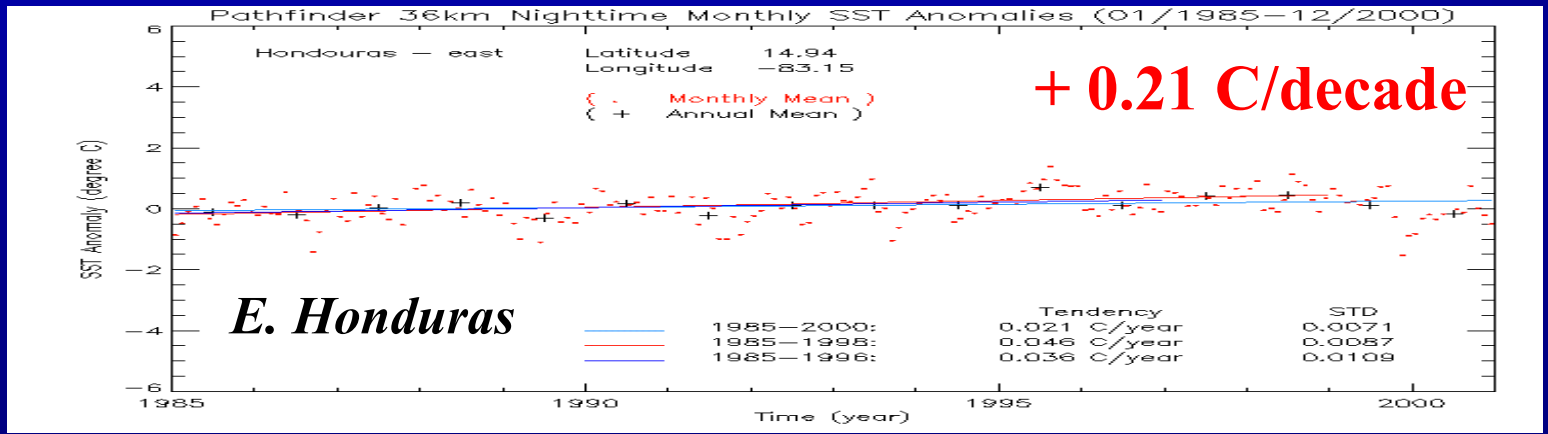


20.2N



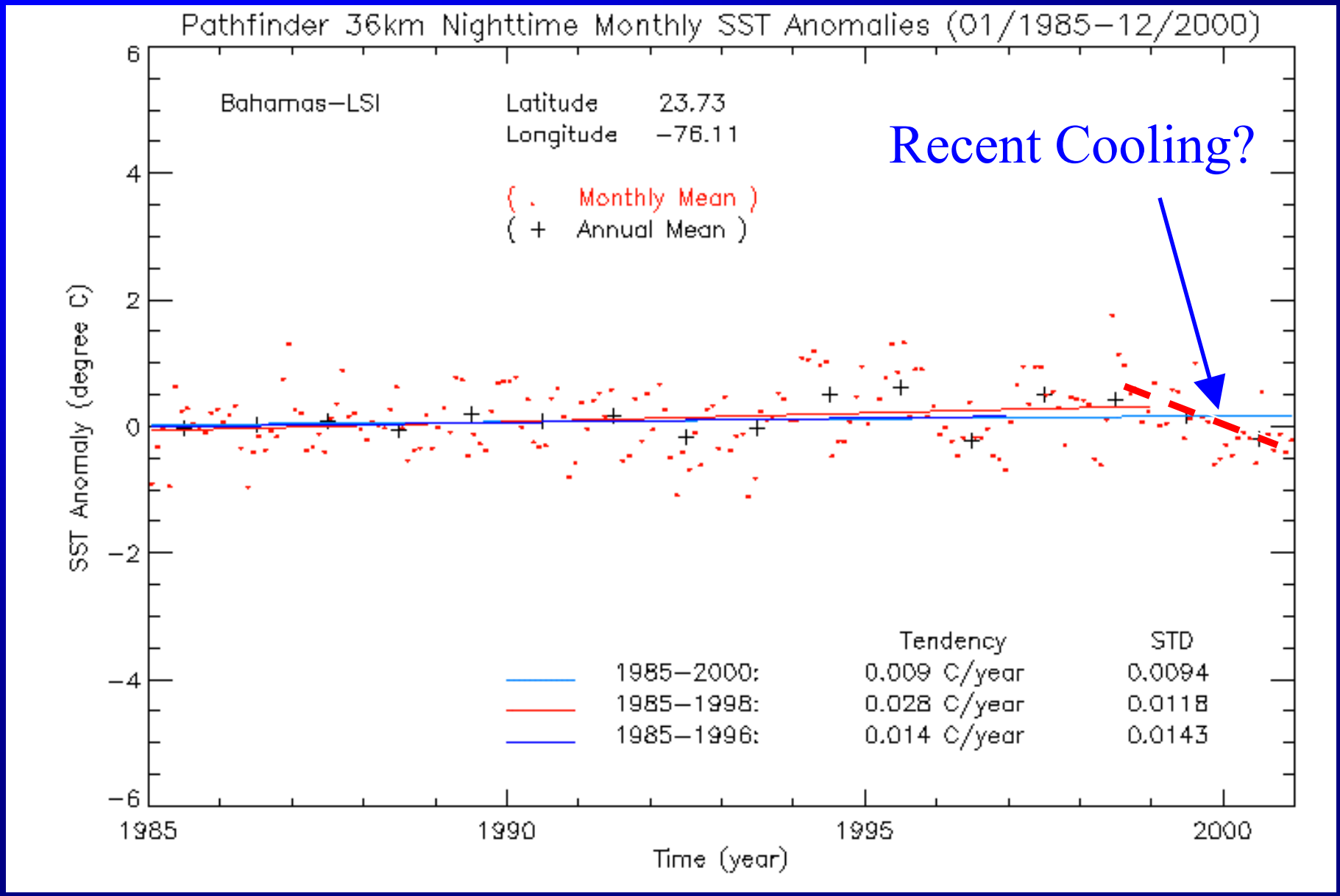


16.4N



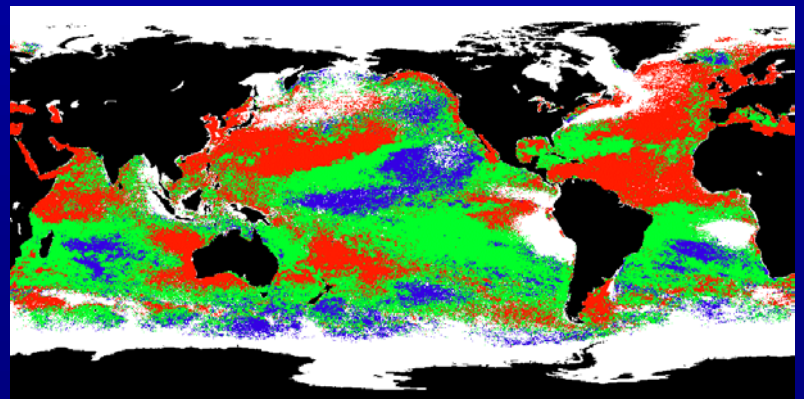
14.8N

LSI – SST Time Series (1985-2001)

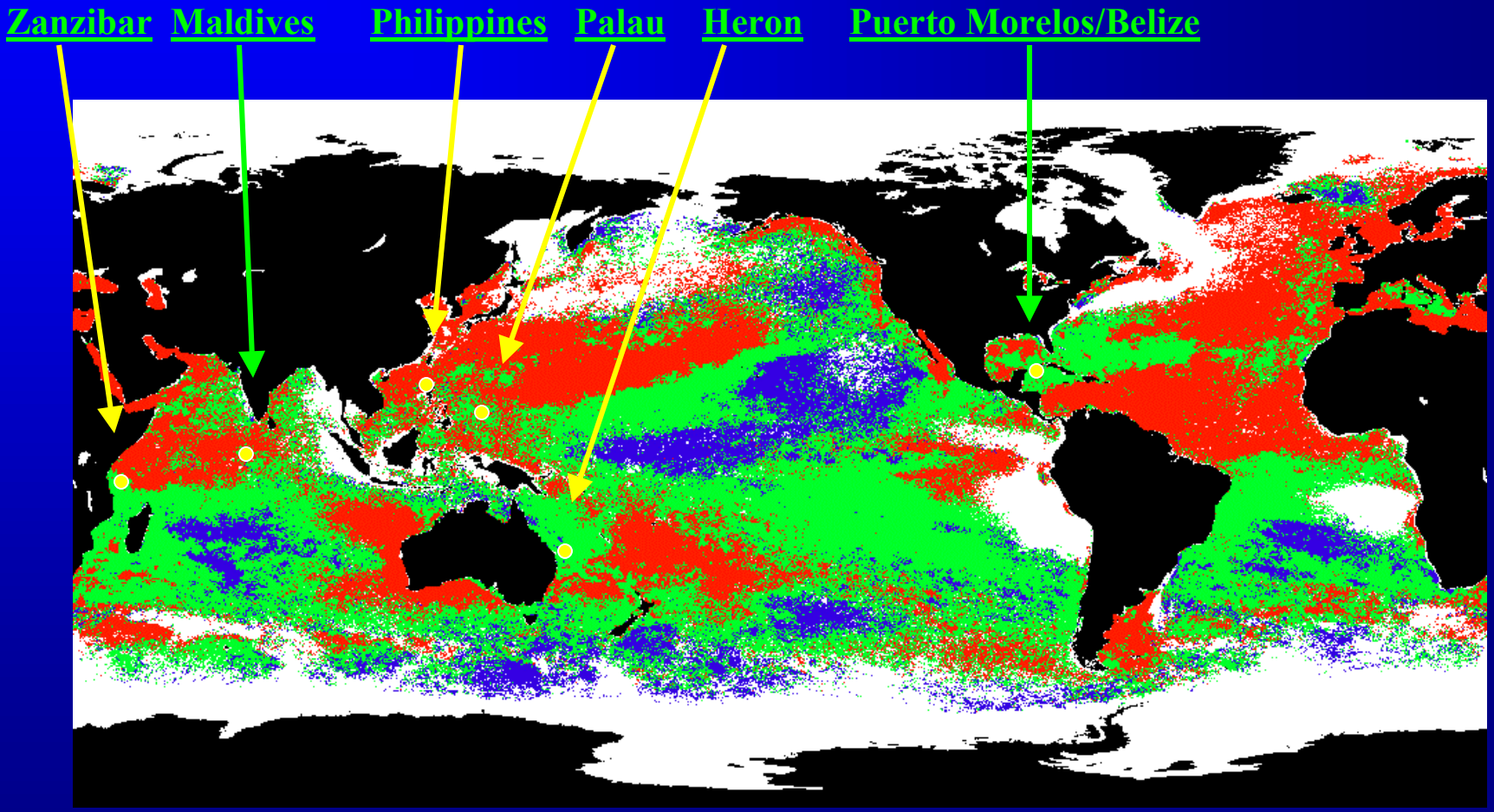


Other potential sites

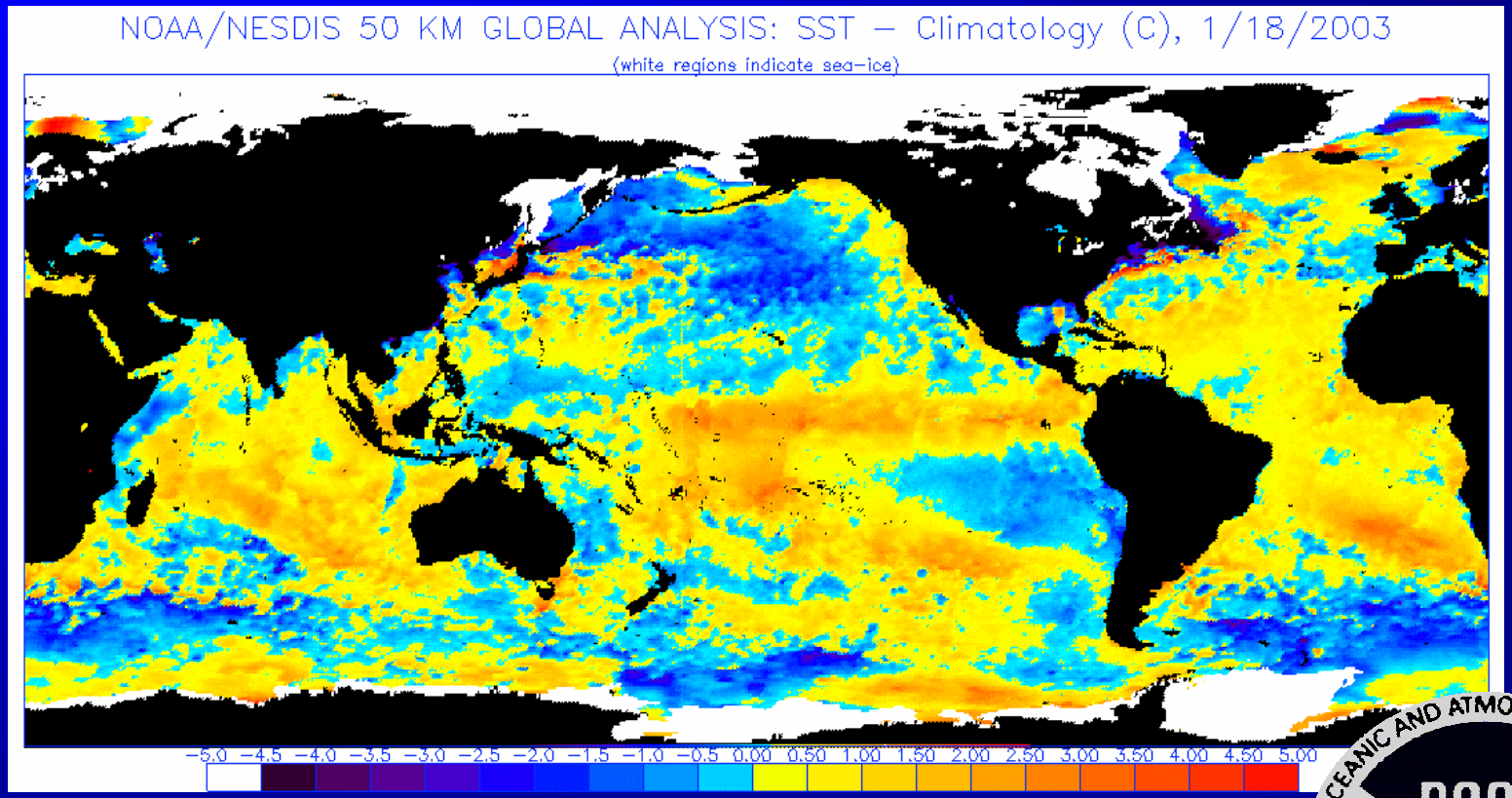
- Fiji ?
- New Caledonia ?
- Bunaken / Manado ?
- Philippines ?
- Zanzibar ?
- Mauritius ?
- Seychelles ?
- Bahamas ?
- Turks & Caicos ?
- Barbados ?
- USVI ?
- Florida Keys ?
- Puerto Morelos ?



Targeted Research Sites vs. Recent Climate Changes



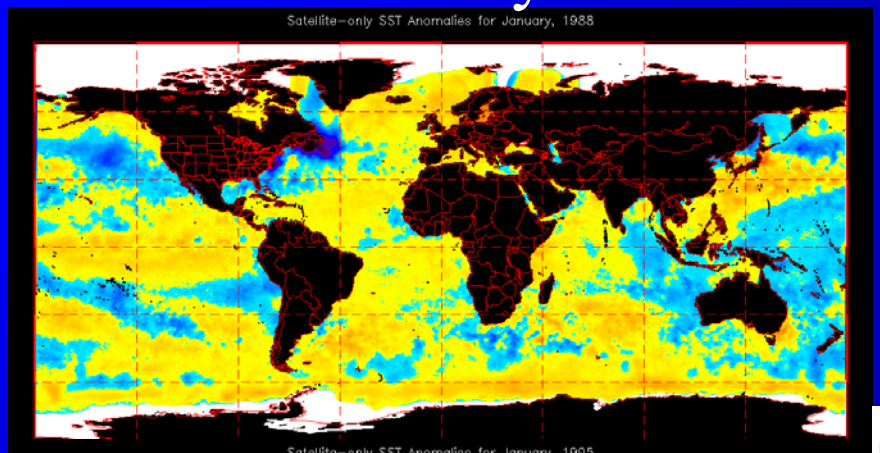
2003 El Niño – weak to moderate



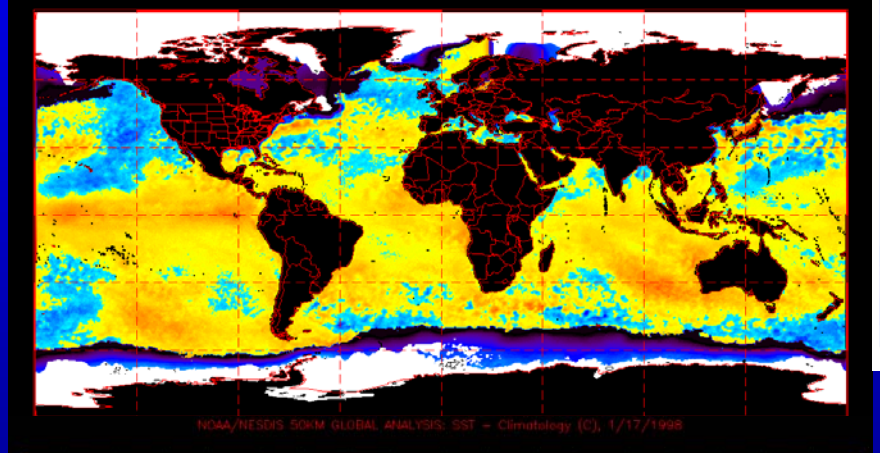
Recent El Niños

January

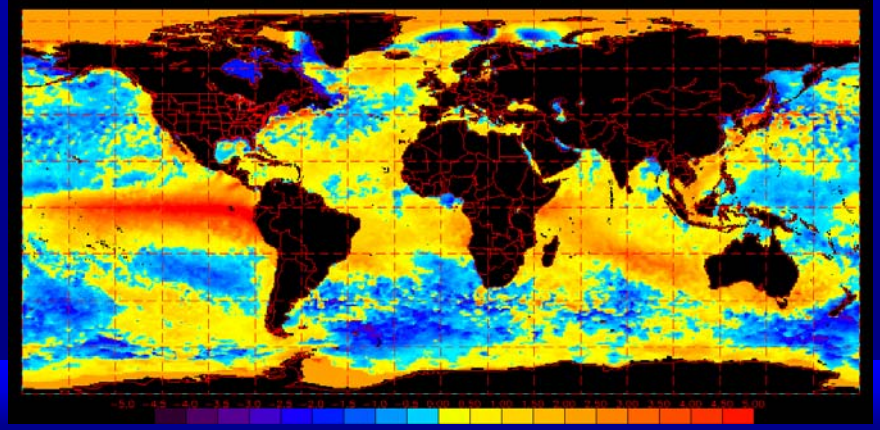
1988



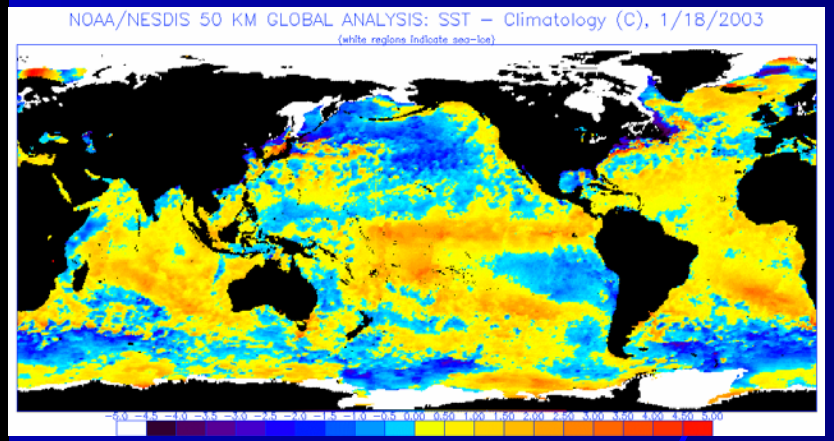
1995



1998



2003



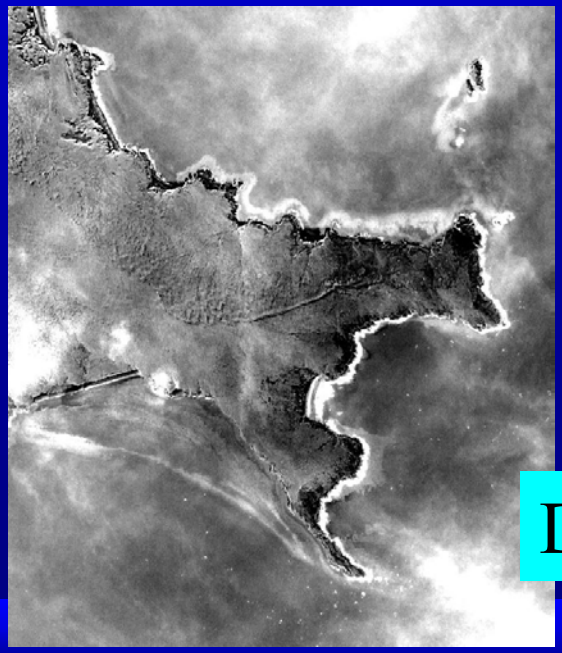
IKONOS Catches GBR Bleaching Event

Before

08/22/01

After

04/15/02

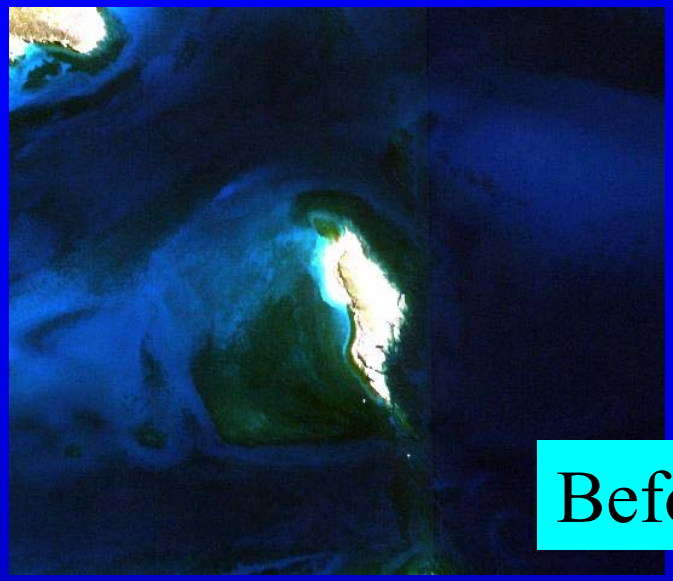


Difference

East End of Great Keppel Island

Band 1 of 8/22/01 scene subtracted from band 1 of 4/15/02 scene.

IKONOS Catches GBR Bleaching Event

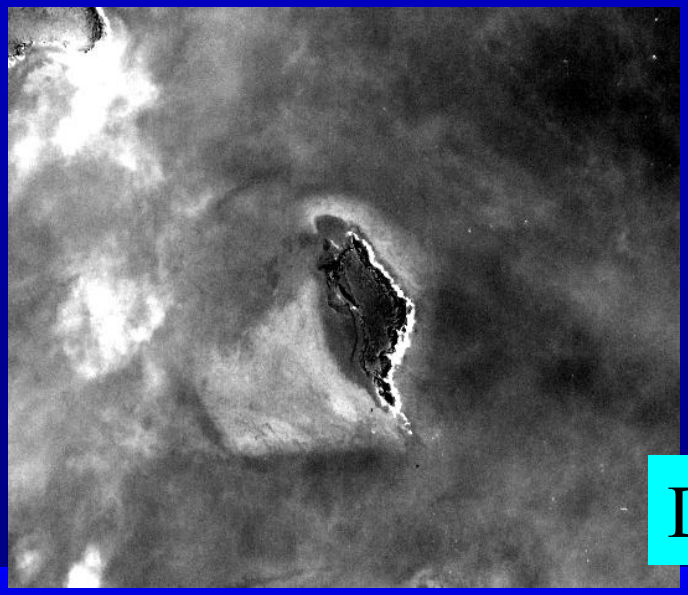


8/22/01

Before

4/15/02

After



Difference

Halfway Island

Band 1 of 8/22/01 scene subtracted from band 1 of 4/15/02 scene.

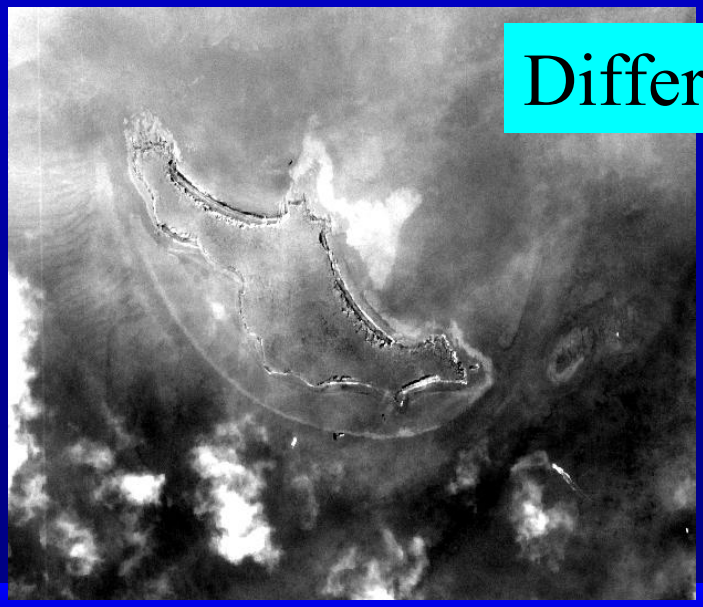
IKONOS Catches GBR Bleaching Event

Before

8/22/01

After

4/15/02



Difference

Middle Island

Band 1 of 8/22/01 scene subtracted from band 1 of 4/15/02 scene.